

# **Clean Energy and Climate Change Response in California: The Nexus between Policy and RD&D**

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# California's Long Path to Clean Energy

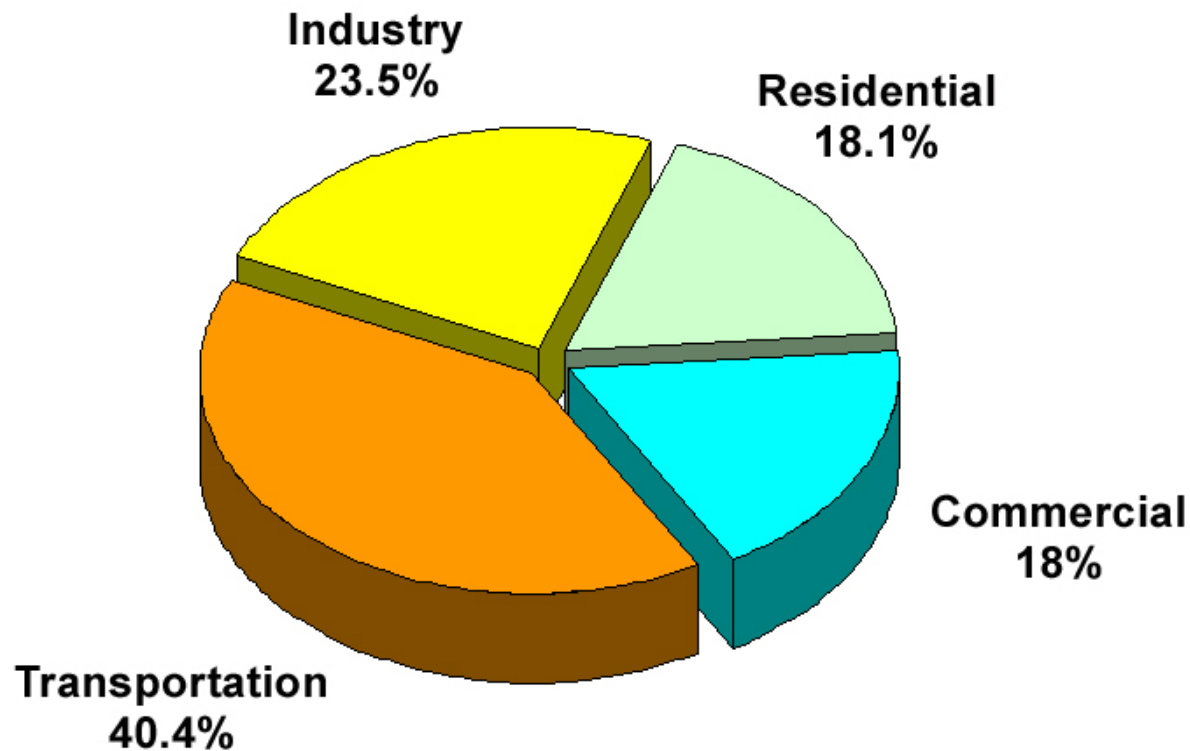
## 1970-2007



- **1971 – CARB automotive NO<sub>x</sub> standards**
- 1978 – No new nuclear power without permanent storage
- **1982 – IOU rates of return decoupled from volumes; Building and Appliance efficiency standards created with updates every three years; utility efficiency incentive programs established**
- 1991 – CARB establishes specifications and properties of reformulated, low emission gasoline.
- 1996 – PUC recommends electricity deregulation plan.
- 1997 – SB 90 deregulates IOUs and creates Public Interest Energy Research (PIER) program.
- **2002 – Legislature enacts “the Loading Order” following 2001 Deliverability crisis. Deliver on new demand with 1) Efficiency and Demand Response, 2) Renewables, and 3) Clean Fossil Generation and Distributed Generation.**
- **2003 – Renewables Portfolio Standard enacted.**
- 2005 – PUC orders \$2.2B, 3 year Efficiency procurement for the IOUs.

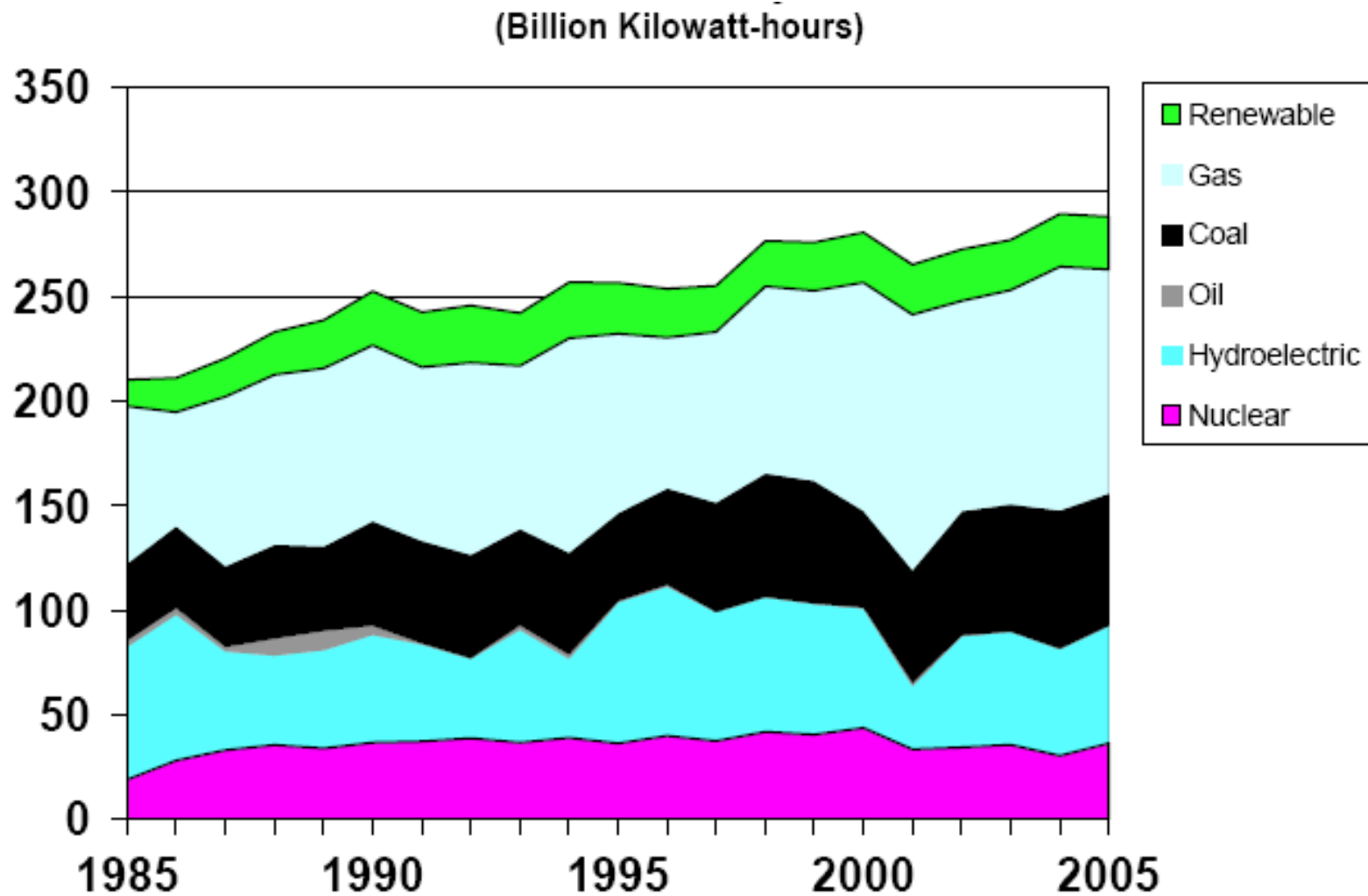
*An Abbreviated Chronology*

# Where is California's Energy Used



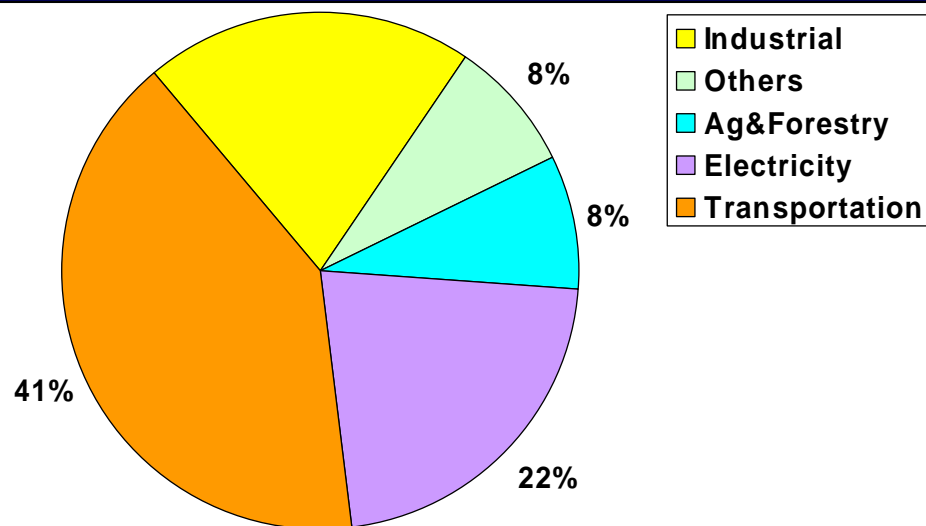
**CALIFORNIA**  
**ENERGY CONSUMPTION 2003**

# Historical California Electric Energy Resources

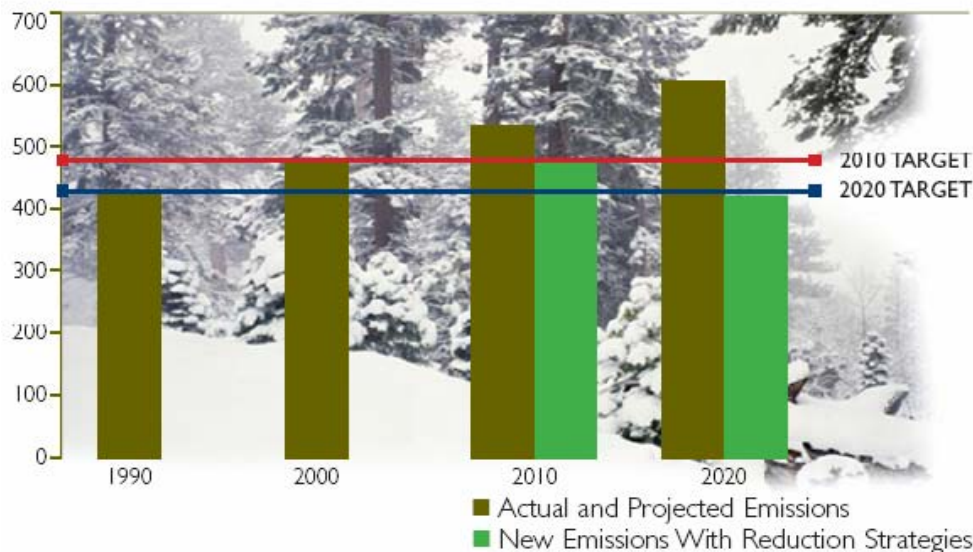


# California Responds to Global Warming

## 2000 - 2007



California Carbon Dioxide Emissions by Energy Sectors, 2004  
~400 million metric tons carbon dioxide



- In 1988 GHG impacts review mandated
- In 2000, the California Greenhouse Gas Registry was established
- In 2002 AB1493 (Pavley) mandates 30% reduction GHG emissions in new light duty vehicles by 2016
- In 2005, AB 1007 requires plan to replace gasoline use with low carbon alternatives.
- **AB 32 – Global Warming Solutions Act of 2006; aggressive goals for 2020**
- **SB 1368 – GHG Emissions standards for IOUs and POUs**
- **AB 2021 – Energy Efficiency for POUs**
- **AB 2160 – Green Building Acquisition Financing for State Facilities**
- **SB107 – Accelerated RPS Goals – 20% by 2010**
- **SB1 – Renewables Goals for New and Existing Residential and Commercial Structures**
- **AB 2778 – Self-Generation Incentive Program for Fuel Cells and Wind**
- **SB 1250 – PIER and Renewables Incentive Programs Reauthorized**
- In 2007, Governor mandates development of Low Carbon Fuel Standard.

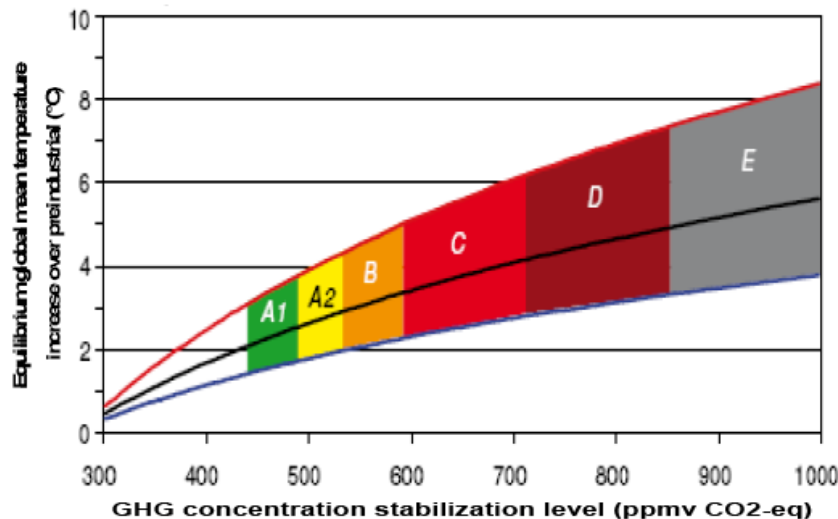
# IPCC Fourth Assessment – Mitigation WG3

- In order to stabilize the concentration of GHGs in the atmosphere, emissions would need to peak and decline thereafter. The lower the stabilization level, the more quickly this peak and decline would need to occur. Mitigation efforts over the next two to three decades will have a large impact on opportunities to achieve lower stabilization levels (*high agreement, much evidence*).

**Mitigation and Adaptation Required**

**Temperatures Will Rise**

Stab level (ppm CO <sub>2</sub> -eq)	Global Mean temp. increase at equilibrium (°C)	Year CO <sub>2</sub> needs to peak	Reduction in 2050 compared to 200
445 – 490	2.0 – 2.4	2000 - 2015	-50 to -10
490 – 535	2.4 – 2.8	2000 - 2020	-60 to -30
535 – 590	2.8 – 3.2	2010 - 2030	-30 to +5
590 – 710	3.2 – 4.0	2020 - 2060	+10 to +60
710 – 855	4.0 – 4.9	2050 - 2080	+25 to +85
855 – 1130	4.9 – 6.1	2060 - 2090	+90 to +140

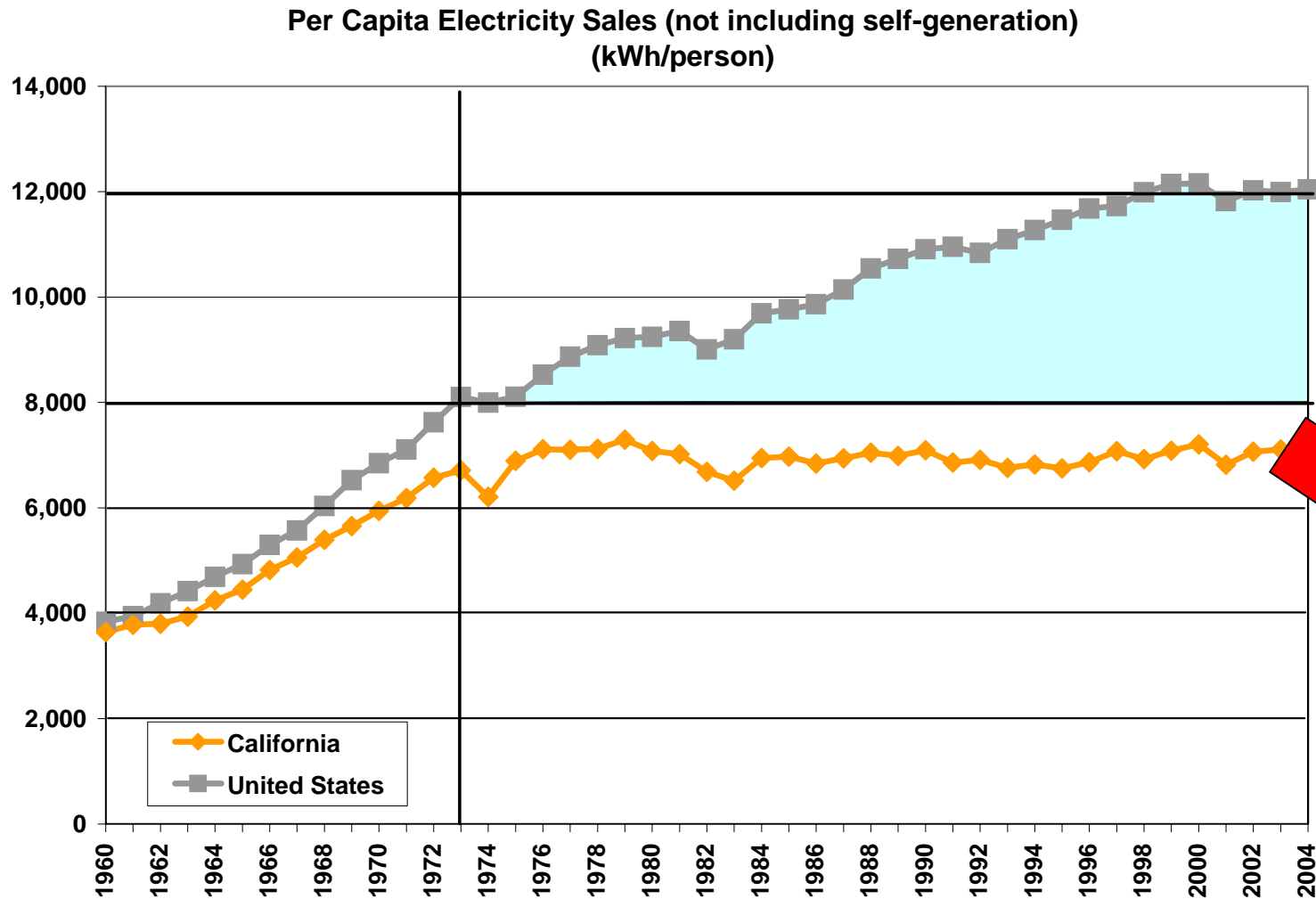


**550ppm concentration CO<sub>2</sub>eq Represents 2X Pre-Industrial Levels**

**To Maintain 550ppm Requires that Emissions Peak between 2010 and 2030**

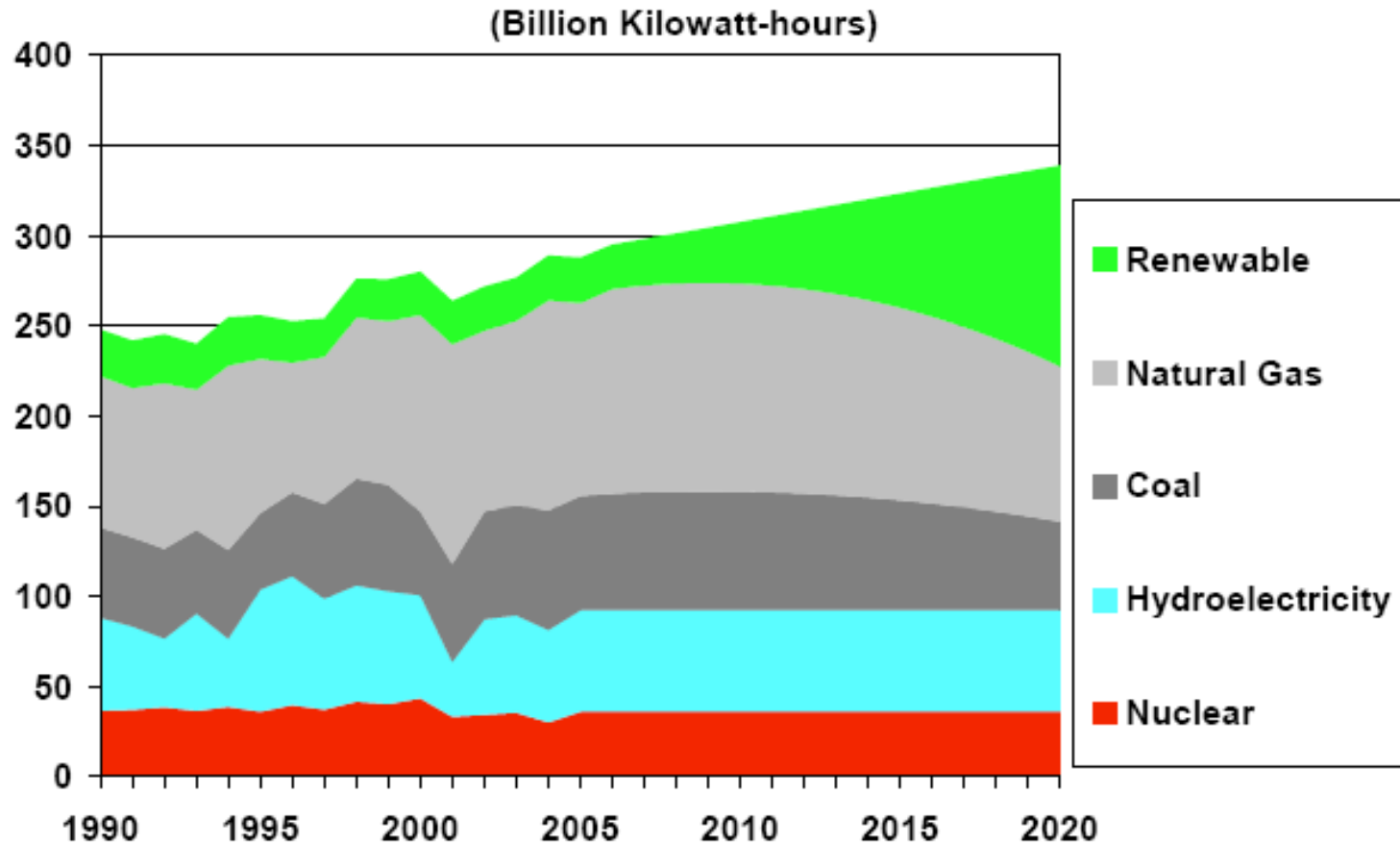
**The World is Committed to Significant Temperature Increases of ~ 3°C**

# Per Capita Electricity Use Needs to Decline *Even In California*



# California Electricity, All Resources

Possible AB 32 scenario - equal CO2 emissions from coal and gas

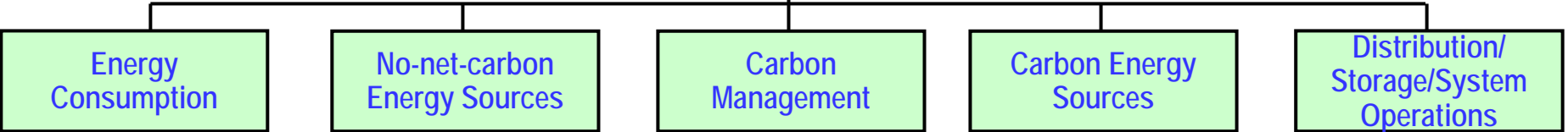


Ferguson, CEERT, March 2, 2007 before the CPUC

***Meeting California's 2020 Emissions Goals in the Electricity Sector Will Present Major Technical and Institutional Challenges***



Research for a Climate Responsive Energy Future in California  
Supply, Distribution, Consumption, and Carbon Management

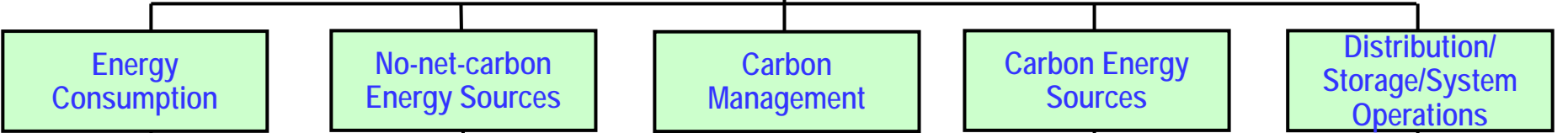


# Comprehensive Energy RD&D Framework in the Manner Of the Department of Energy

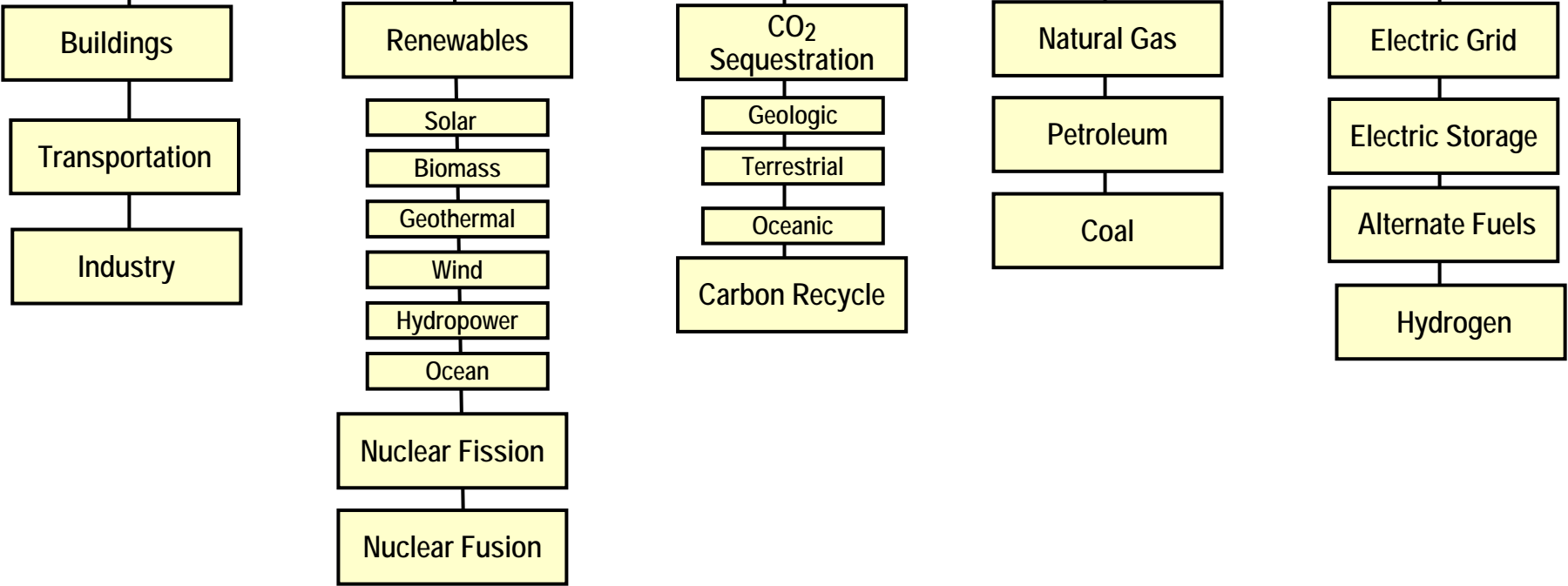


## Research for a Climate Responsive Energy Future in California Supply, Distribution, Consumption, and Carbon Management

### Decision Science and Complex Systems Science



### Energy Conservation, Energy Efficiency, and Environmental Stewardship Global Climate Change Science



# SB 1250 Reauthorized PIER in 2006 and Established Solution- Focused Goals



## General Goal

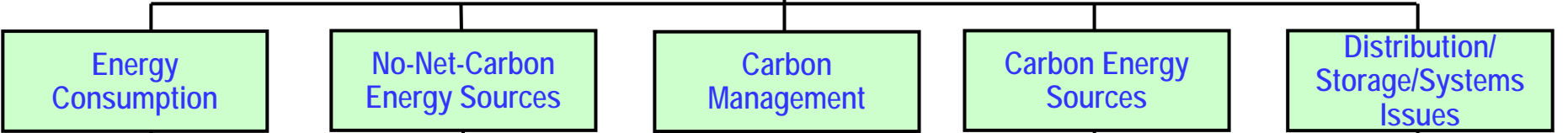
- “Develop and help bring to market, energy technologies that provide increased environmental benefits, greater system reliability, and lower system costs”

## Specific Goals

- Develop and help bring to market
  - “Advanced transportation technologies that reduce air pollution and greenhouse gas emissions beyond applicable standards, and that benefit electricity and natural gas ratepayers.
  - “Increased energy efficiency in buildings, appliances, lighting, and other applications beyond applicable standards, and that benefit electric utility customers.
  - “Advanced electricity generation technologies that exceed applicable standards to increase reductions in greenhouse gas emissions from electricity generation, and that benefit electric utility customers.
  - “Advanced electricity technologies that reduce or eliminate consumption of water or other finite resources, increase use of renewable energy resources, or improve transmission or distribution of electricity generated from renewable energy resources.”

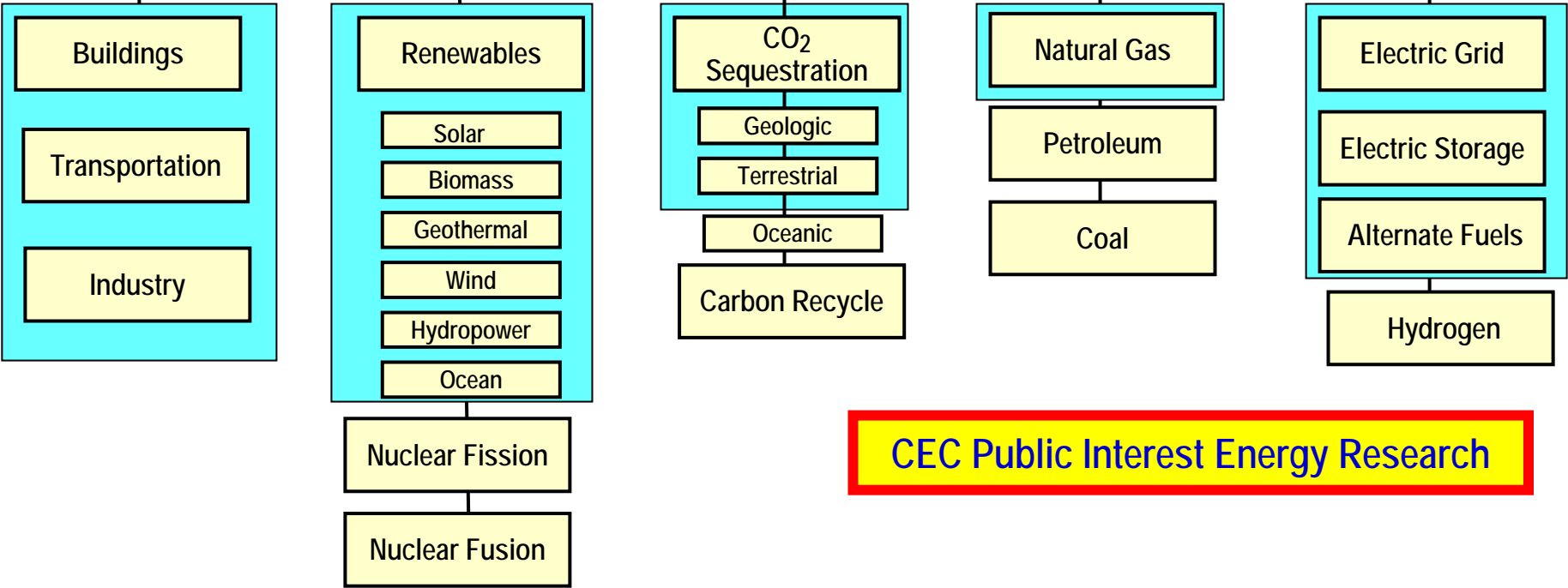
Research for a Climate Responsive Energy Future in California  
Supply, Distribution, Consumption, and Carbon Management

Decision Science and Complex Systems Science



Energy Conservation, Energy Efficiency, and Environmental Stewardship

Global and Regional Climate Change Science



Thank You

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